

# (12) UK Patent Application (19) GB (11) 2 239 763 (13) A

(43) Date of A publication 10.07.1991

(21) Application No 9022684.6

(22) Date of filing 18.10.1990

(30) Priority data

(31) 892430

(32) 23.10.1989

(33) AT

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(51) INT CL<sup>5</sup>

H04N 5/64

(52) UK CL (Edition K)

H4F FD32 FD45 FJH

H4J JAB J30B J30F J30L J31R

(56) Documents cited

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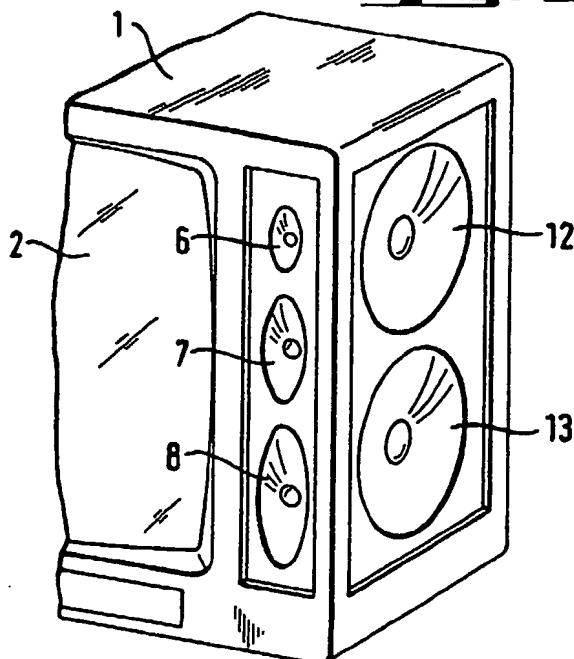
(58) Field of search

UK CL (Edition K) H4F FJH, H4J JA JAB

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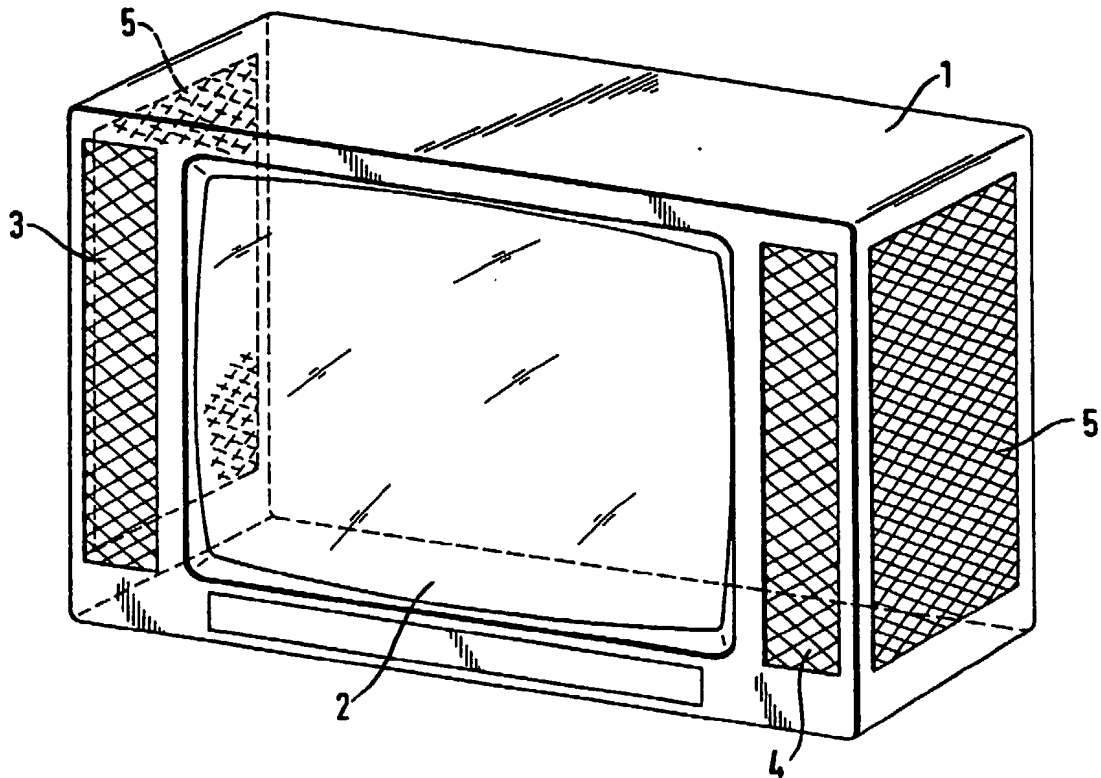
(54) "Television receiver with stereo sound reproduction"

(57) In a television receiver particularly of the HDTV type having stereo sound reproduction, front loudspeakers 6 – 8 are disposed at the front of the receiver on both sides of the screen 2 and side loudspeakers 12, 13, which are also suitable for transmitting the entire audio frequency range, are disposed in the two side walls of the receiver. A further speaker mounted in the top wall and aimed at the ceiling may be present. The action of the side speakers may be delayed to provide a concert hall sound. There may be remote control of the level/frequency characteristic/transit time of each speaker group to adjust the acoustic image in accordance with the viewed image or to adjust to the room acoustics.

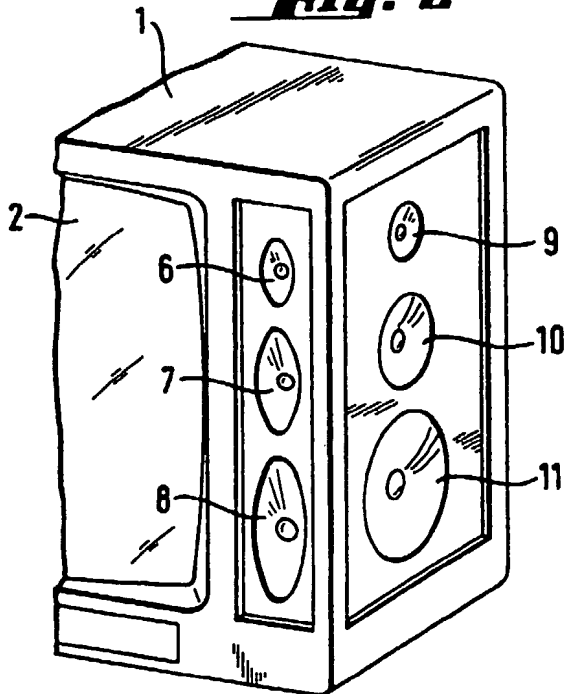


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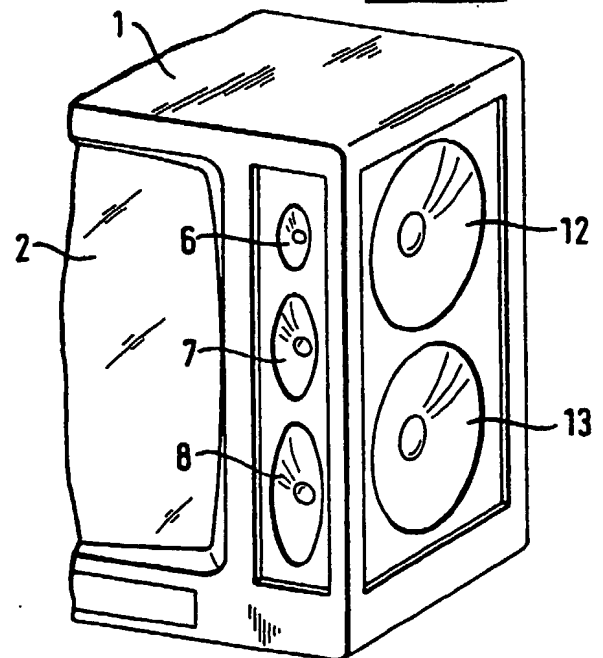
**Fig. 1**



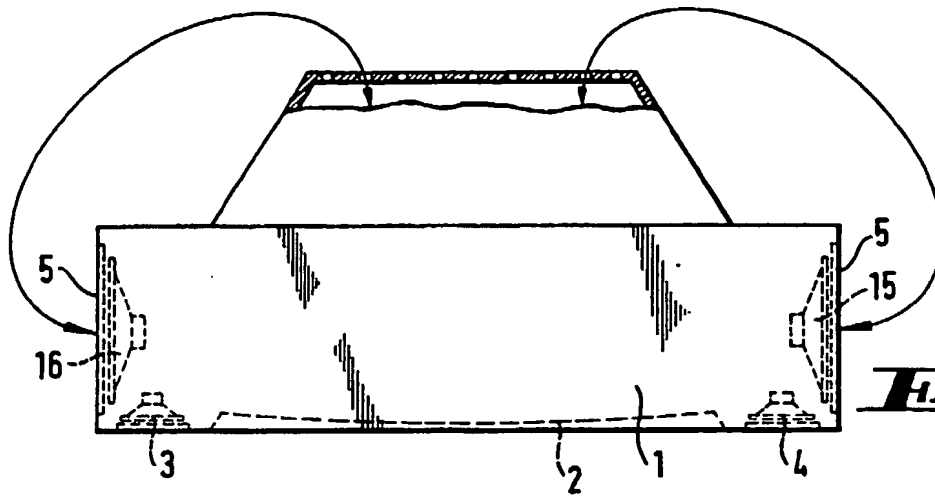
**Fig. 2**



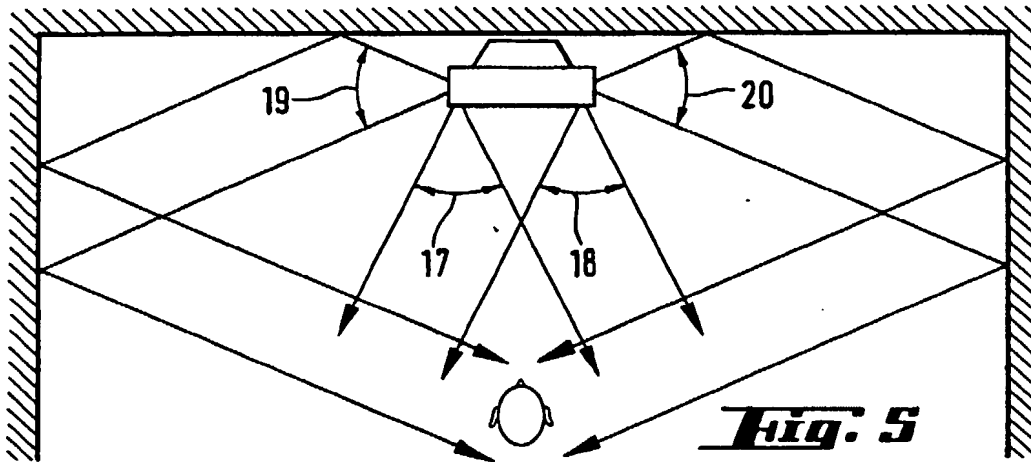
**Fig. 3**



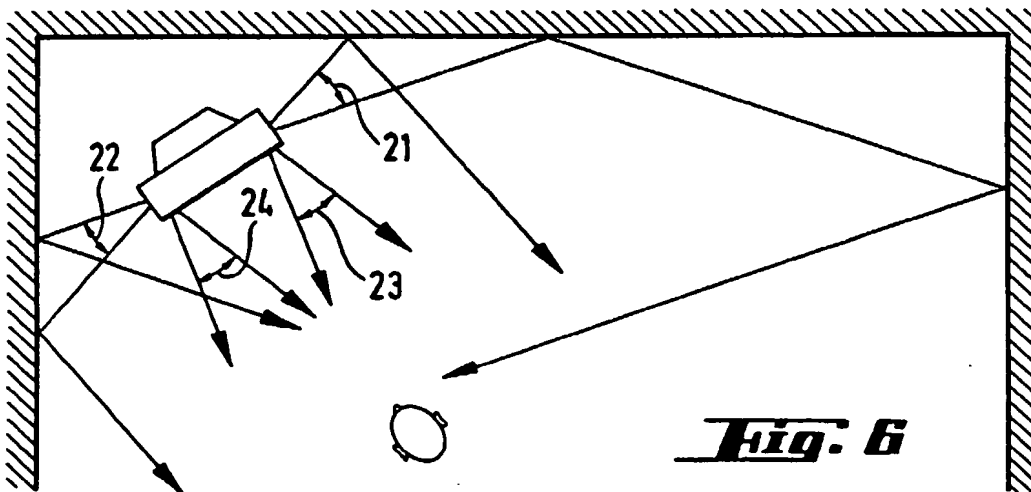
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**Fig. 4**



**Fig. 5**



**Fig. 6**

## Description of Invention

### "Television receiver with stereo sound reproduction"

THIS INVENTION relates to a television receiver having stereo sound reproduction, more particularly of the HDTV type, the new standard for picture and sound reproduction, which receiver has loudspeakers disposed at the front of the receiver on both sides of the screen.

Because of the enlarged picture area, which already comes close to that of a home cine, at least a two-channel stereo system must be used for sound reproduction.

The use of two loudspeakers in the conventional stereo base set-up to form a phantom sound source in the room, or even the use of a number of loudspeakers disposed around the viewer, cannot be regarded as a satisfactory solution to the problem of stereo reproduction since a three-dimensional perspective arises only in the simulation plane between the loudspeakers and even minor deviations from the loudspeaker centre give rise to a tendency to hear the adjacent loudspeaker.

The invention relates to an arrangement of loudspeakers in a television receiver enabling the "surround sound" needed to perceive the spatial effect to arise as in a correct hall without loudspeakers having to be distributed around the room.

Conventionally, small loudspeakers have been fitted in narrow vertical surfaces on both sides of the

image area or else loudspeakers have been rotatably mounted outside the receiver side walls on a pivot in small housings which are detachable so that they can be arranged on a stereo basis in the room.

The present invention improves upon this system, which is unsatisfactory for three-dimensional listening, and provides a television receiver having stereo reproduction, the receiver having front loudspeaker means disposed at the front of the receiver on both sides of the screen, in which receiver side loudspeaker means also suitable for transmitting the entire audio frequency range are disposed in the two side walls of the receiver.

The loudspeakers of a television receiver embodying the invention, because of their alignment, radiate towards the room walls and provide the essentials for important effects of three-dimensional hearing, more particularly an enlargement of the hearing zone.

According to a preferred feature of the invention, to form a subsequent first lateral sound or a number of lateral sound reflections the side loudspeaker means have an electrical transit time delay feature corresponding to the experience of sound in a large concert hall.

Four or more reproduction channels can be provided for this purpose as is now being considered for future HDTV domestic reception since correspondingly more loudspeakers can be accommodated in the receiver side walls.

Both dynamic and electrostatic loudspeaker systems can be disposed on the receiver side walls.

According to another preferred feature of the invention, top loudspeaker means pointed towards the

ceiling of the room are disposed in the top casing wall of the television receiver. The advantage of this feature is that radiating the sound towards the room ceiling enhances the sound distribution as if in a concert hall.

In this respect television receivers, more particularly of the HDTV type, can have provision to produce an image-dependent variation of stereo sound reproduction such that a narrow listening zone giving enhanced clarity and presence is provided for the display of persons in the image, whereas the hearing zone is widened when the image expands and it is required to simulate spatial depth. For example, a singer or actor is required to have a close effect for enhanced clarity without room reflections whereas in the case of an expanded sound in a large room or in the open air the sequence of direct signal, reflections and echo plays a part. Advantageously, for example, the loudspeaker reproduction of the television receiver is adaptable in accordance with the image in the representation of direction, distance and spatial impression by means of remote control.

For this purpose the level and/or frequency characteristic and/or transit time can be provided for each loudspeaker group by separately acting electrical and/or acoustic adjusting elements and ultrasonics, infra-red or the like can be used for this purpose in known manner. Also, differences in the reflecting properties of the room walls can be allowed for and optimal three-dimensional sound can be adjusted subjectively.

Finally, for optimal spatial impression in the case of headphone stereophony, ear resonances which have either already originated in the microphone recording by means of an artificial head or artificial ear microphone

or which are produced, e.g. digitally in the television receiver can also be used on an analog or digital basis.

In order that the invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a television receiver embodying the invention, with details omitted for clarity;

Figure 2 is a fragmentary view of the Figure 1 receiver, showing the right-hand part of the receiver with the loudspeakers fitted and the protective grille removed;

Figure 3 shows a modified embodiment of the television receiver with two large loudspeakers on the side wall;

Figure 4 is a plan view of a television receiver embodying the invention;

Figure 5 shows the propagation of the sound waves both from the small front loudspeakers and from the side loudspeakers when a television receiver embodying the invention is placed at the centre of the wall of a living room; and

Figure 6 shows the pattern of the sound waves from the loudspeakers when the television receiver is placed in a corner of a living room.

Figure 1 illustrates diagrammatically a television receiver embodying the invention. A casing 1 receives a screen 2 and, on both sides thereof in the image plane, a respective front loudspeaker row 3, 4 as is conventional

in television receivers. However, in the receiver embodying the invention, the entire surface of both side walls of the receiver casing is also intended for side loudspeakers which are disposed behind the sound-pervious protective wall 5.

Figure 2 shows front loudspeakers 6 - 8 of the row 4 with the protective wall removed arranged conventionally and also shows additional side loudspeakers 9 - 11 which are intended, by being arranged on the side of the receiver, to radiate sound towards a living room wall facing the loudspeakers. A similar arrangement of loudspeakers is provided at the front and side of the left-hand part of the receiver casing 1.

The size of the loudspeakers 9 - 11 can vary or, as shown in Figure 3, have the very substantial dimensions of loudspeakers 12, 13, one of which can operate with and the other without propagation time delay. To produce a unilateral directive effect the loudspeakers can have acoustic delay networks on the back.

Of course, instead of a number of loudspeakers covering the entire audio frequency range being disposed in the receiver side walls, just a single loudspeaker designed for the entire audio frequency range can be disposed in each side wall.

Figure 4 is a plan view of a television receiver embodying the invention and serves to show how a conical part 14 of the housing can serve as a low-frequency acoustic baffle for loudspeakers 15, 16 in order to give a space filling reproduction of low frequencies below 200 Hz, for example, in the reproduction of music.

Figure 5 shows the pattern of sound propagation in a living room when the television receiver is placed in



the middle of a wall of the room. The arrows indicate merely the directions of sound propagation but take no account of complicated frequency-dependent details.

The front loudspeakers provide only a narrow zone 17, 18 of sound propagation which on its own does not provide a large enough hearing zone for music or the like. However, the side loudspeakers provide a wide zone 19, 20 of sound propagation with a sequence of side sound, first reflections and echo, preferably with propagation time delay, and also for optimal space impression, analog or digital ear resonances produced digitally as early as the recording stage by means of a synthetic head or synthetic ear microphone or in the television receiver.

As shown in Figure 6, the side loudspeakers produce a similar effect when the television receiver embodying the invention is placed in a corner of a living room, producing therein a sound propagation zone 21, 22. The front loudspeakers have a sound propagation zone 23, 24 and have the same effect as described with reference to Figure 5.

CLAIMS:

1. A television receiver having stereo reproduction, the receiver having front loudspeaker means disposed at the front of the receiver on both sides of the screen, in which receiver side loudspeaker means also suitable for transmitting the entire audio frequency range are disposed in the two side walls of the receiver.

2. A television receiver according to claim 1, in which to form a subsequent first lateral sound or a number of lateral sound reflections, the side loudspeaker means have an electrical transit time delay feature corresponding to the experience of sound in a large concert hall.

3. A television receiver according to claim 1 or 2, in which top loudspeaker means are disposed in the top casing wall of the television receiver to point towards the ceiling of a room in which the receiver is used.

4. A television receiver substantially as hereinbefore described with reference to the accompanying drawings.

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